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ABSTRACT

With rapid developments in information technology in society being mirrored in the use of new learning technologies in universities, research into the quality of technologically-supported learning is essential. To date, research into new learning technologies has provided us with valuable knowledge that includes the theories behind their design, the variety of situations in which they can be applied and their impact on learning efficiency and effectiveness. Surprisingly, there has been comparatively little research from a student perspective allowing us to reflect on the quality of the learning processes. In this study, a student-focused perspective was adopted to investigate a student writing experience supported by technology in a first-year undergraduate course in plant science and physiology. Interviews were used to reveal variation in the approaches students have adopted to the whole writing experience and the technologically-supported part of that experience. The data provides opportunity for reflection on what constitutes quality learning in student approaches to writing when technologically-supported processes are part of the experience and the results suggest important relationships that require further investigation. (Contains 13 references.) (Author/MES)

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REFLECTING ON QUALITY LEARNING IN A STUDENT WRITING EXPERIENCE SUPPORTED BY TECHNOLOGY

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Abstract

With rapid developments in information technology in society being mirrored in the use of new learning technologies in universities, research into the quality of technologically-supported learning is essential. To date, research into new learning technologies has provided us with valuable knowledge that includes the theories behind their design, the variety of situations in which they can be applied and their impact on learning efficiency and effectiveness. Surprisingly, there has been comparatively little research from a student perspective allowing us to reflect on the quality of the learning processes. In this study, a student-focused perspective is adopted to investigate a student writing experience supported by technology. Interviews are used to reveal variation in the approaches students have adopted to the whole writing experience and the technologically-supported part of that experience. The data provides opportunity for reflection on what constitutes quality learning in student approaches to writing when technologically-supported processes are part of the experience and the results suggest important relationships that require further investigation.

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Keywords
quality, writing to learn, student approaches

Introduction

Universities are embracing new technologies in curricula design to help prepare graduates for the demands of their future professional lives. Research is rapidly expanding in this area, but it is not keeping up with developments in all parts of the field. One under-researched area that requires considerable reflection is the quality of the student writing experience when technology is used to support the experience. In this study, the writing experience of students in a first-year undergraduate subject, Plant Science and Physiology (PSP), is researched. A description of the design and purpose of the technology used in that experience can be found elsewhere (Ellis, 2000). This study investigates the quality of the approaches that students adopt to the whole writing experience in PSP and the approaches they adopt when they use technology that has been integrated into the curriculum to help them to learn through writing. It then examines the relationships between their approach to the whole writing experience and the technologically-supported part of that experience and the implications these findings suggest for quality learning and teaching.

Theoretical Background and Previous Research

In the past twenty years, there has been substantial research into higher education students' experiences of learning (Entwistle & Ramsden, 1983; Crawford, Gordon, Nicholas, & Prosser., 1994; Prosser & Trigwell, 1999). Within that body of research, only a small proportion of it has focused on quality writing experiences, and little if any has considered the relationship between

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learning and technology. This study attempts to redress this by discussing the quality of student approaches to writing when technology supports part of the experience.

Previous student-focused learning research into writing has looked at essay planning, the quality of feedback on essay writing, meaning and context in essays (Hounsell 1984, 1987, 1997) and the process and product of essays (Prosser & Webb, 1994). This research indicated variation in the quality of the student writing experience. Some students' experience of writing focused more on the structural aspects of the experience, while a second group of students were also simultaneously aware of the referential aspects (Marton & Booth, 1997; p. 145). It is this latter group which related the writing process and product to one of meaning and it is approaches adopted by students in this group which constitute a quality approach to learning when students write. They write with the intention of making meaning and in order to do this they need to understand what they are writing. Thus they write not only to improve their written expression of their discipline, but they write to further their understanding of the content being written about. This is a version of writing to learn, an approach to education used extensively in North America since the 1970s (McLeod, 1992; Russell, 1994). The above field of research informed the reflective research approach used to investigate the learning context of this study.

The Learning Context of this Study

The learning context researched in this study is a first year undergraduate science subject, Plant Science and Physiology (PSP). Students enrolled in this subject were required to complete a scientific writing portfolio. The portfolio comprised eight writing tasks which were completed at regular intervals throughout the term. The students were expected to start with shorter tasks, which gradually became more demanding as the term progressed. Their complexity increased not only in terms of length (between 300 and 1000 words), but also in terms of content and purpose. The content addressed in the tasks included cell biology, plant nutrition, the domestication of plants, the structure of genomes, DNA, Plant Growth and Development. The purpose of the tasks varied, including genres of explanation and description, to more demanding ones of discussion and exposition. By completing regular shorter texts than the typical end of term essay, the design of the portfolio allowed for a greater focus on the writing process. Students received more systematic feedback on each of the eight tasks than they would have received from one or two longer essays.

To help the students engage in the process, a scientific writing database was introduced into the curriculum. This database comprised around 300 texts and text segments which were used as models and one type of feedback in students writing processes. The contents of the database were moderated, annotated and edited versions of previously enrolled student texts. The database was networked and combined with a bulletin board to allow asynchronous collaboration amongst students and with the lecturers. Together the technology is referred to as the PSP Interactive Learning Environment (PSPILE) (Ellis, 2000)

Students could begin preparation and writing of the portfolio tasks either before or during the related tutorial. A typical student writing process of students in this subject would involve receiving feedback from the previous writing task, analysing a textual model, completing modeling exercises in the database that foregrounded specific referential and structural concepts, collaborating with other students (either in class or asynchronously) and then individually writing their texts. Thus the relationship between their writing experience and the technologically-supported part of the experience can be represented as shown in Figure 1.

For students in PSP, approaches to the whole writing experience meant the approaches they adopted in tutorials, workshops and lectures, while the technologically-supported part of that experience referred to those instances when they used the PSPILE in their writing processes. To investigate the student writing experience, 22 interviews were conducted out of a cohort of 51 students. The interviews were completed at the end of the semester after the students had experienced writing the scientific portfolio tasks. They were 20 minutes in length and fully transcribed.

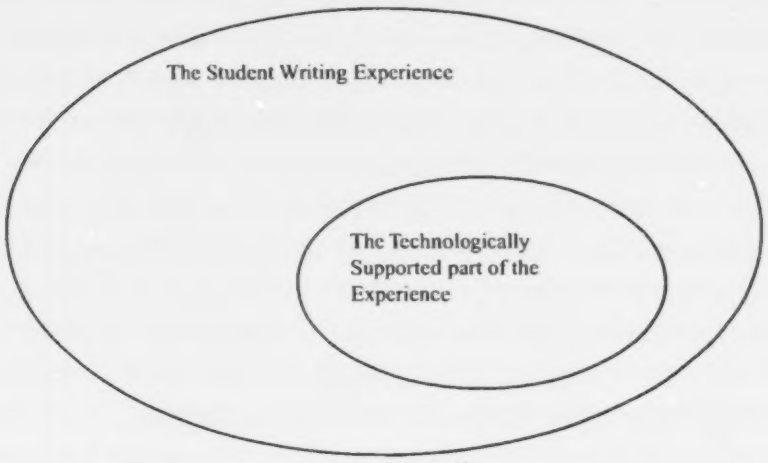

Figure 1: The relationship between the whole student writing experience and the technologically supported part

The Research Questions Addressed by the Interview Questions

Research questions consistent with the model of learning described above and addressed by the interviews were:

1. What are the categories and distributions of approaches to writing for students in Plant Science and Physiology?
2. What are the categories and distributions of approaches to technologically-supported writing process for students in Plant Science and Physiology?
3. Are there relationships between any of these elements of the student experience of writing?

In order to research these questions in the learning context, an interview process was developed. To increase the reliability of the results of the interviews, the process and questions were designed to be consistent with previously published methodologies used to investigate student learning (Crawford et al.,1994), expert advice was sought (Prosser & Trigwell, 1999) and the interview process was trialled on three students. As a result of the trial, the wording of the questions was tightened and the familiarity of the process allowed the interviewer to focus more on the students interviewed in the main study to probe the meaning behind their responses.

In a phenomenographical approach to researching student learning, categorization of the approaches used by students in the learning experience are an integral part of the study. The following begins with the student approaches to the whole writing experience revealed in the interviews.

Interview Extracts Of Student Approaches To Writing in PSP

The questions used in the interview to investigate student approaches to writing were:

What was your approach to writing in PSP and why did you approach your writing that way?

The question above asked students to reflect on their approach to the whole writing experience of PSP, writing in the lectures, workshops and tutorials. The extracts from interviews discussed here are from students who represent the categories of approaches that students brought to writing in PSP.

Approach 1

When asked about his approach to writing in PSP, Brad replied:

> "I would research, source all the information, put it in point form and then transform that into the actual essay. I just put them straight onto the computer, that's my style and then go through

and check it. I would check the spelling and grammar."

When pressed to explain further about his approach to writing, Brad replied:

"It has a definite introduction, a body explaining it and then there is an end…I put it through the spell checker and the grammar checker at the end, but that's all."

When Rebecca asked how she approached her writing in PSP, she replied:

"I tried to take out the main ideas in the books and I wrote down the main ideas… and later I wrote a draft incorporating the notes from the lecture."

When asked how she organized the ideas, Rebecca replied:

"I decide which one comes in the first part and which in the body and which in the last part."

When Rebecca was asked to explain what she meant by "part", she replied:

"I mean the section of the report".

Approach 2

When asked the same question as the previous students, Damian replied:

"I'd try to get some kind of structure and then I'd go through and write a paragraph and see how it sounded if it was alright, or if I was having troubles with it, I'd come back later."

When asked what he meant by "come back later", Damian explained:

"I'd go through and try to pull apart my own work and see what I'm doing wrong… checking all the information was there"

When asked why he was revising, Damian added:

"Well mainly (for) the marks, like I'd look at well, what does the lecturer want and okay, how can I best fulfil requirements."

Asked how she approached her writing, Kieran replied:

"Yeah I would change stuff….When I write off the top of my head it doesn't always make sense."

Asked what she was changing, Kieran responded:

"Grammatical (things) mostly but sometimes the information is around the wrong way."

Approach 3

When asked how she approached her writing, May replied:

"Well first of all for academic tasks I'd go through the modules that were related to that task. Read through all of those, make notes as I went. Read through whatever notes I've made in the lectures, then I'd read through the relevant chapters, try and summarise those and pull out the most relevant points on those.

When asked what she did after her preparation, May continued:

"Once I've got all the information down and I understand what's going on, then I just sit down and write it...and make sure it all makes sense and I do understand the Science as I'm going along."

When asked about his approach to writing, Col replied:

"I'd go away and read up some text books and lecture notes, and then I'd start doing a draft and see how that pans out, read through it and just keep going back to what is the model and what sort of things are expected"

When asked what was the most important aspect of his approach to writing after completing his preparation, Col replied:

"Revising for making a better writing task and also so you can improve the Science and understand the Science better".

Student Approaches To the Whole Writing Experience in PSP

The above quotations differ in their structural and referential aspects. In referential terms approach A foregrounds grammar, spelling, structure, as does B. However B also foregrounds a task awareness evident in the focus on marks and an intention to "pull apart" the work or "change things (when the) information is around the wrong way". In contrast, approach C foregrounds an intention of acquiring scientific knowledge and how to express that knowledge appropriately when writing. There is a qualitative shift in the intention of the students between approaches B and C: moving from learning to write for the purposes of completing the task, arranging information, and checking textual features, to writing to acquire knowledge about the science and its written form.

In structural terms, approach A is characterized by checking the grammar and spelling and checking the structure. Approach B emphasises the completion of the task and arrangement of information as well as checking the surface features of the text. Approach C emphasises a growing understanding of the science and an understanding of how to express the science appropriately.

The above referential and structural aspects of student approaches to writing in PSP describe the variation in the student writing experience (Marton & Booth, 1997; p. 145). The three qualitatively different categories of description exemplified by the above extracts from the interviews are:

Category	*Description*
Approach A	Writing to copy and check structure grammar and spelling
Approach B	Writing to complete the task, arrange the information and use appropriate language
Approach C	Writing to understand the science and to express it appropriately

Table 1: Student approaches to the whole writing experience in PSP

Referentially, approaches A and B separate understanding the content from the writing process and are therefore multistructural. In contrast approach C is a relational one, one which approaches writing as a way of understanding the content and how to express it appropriately. Structurally category B is inclusive of A, and C is inclusive of B and therefore empirically inclusive. This means students in category B also have strategies of A at their disposal and students in C have strategies of B at their disposal.

In the interviews, students were also asked to focus on the technologically-supported part of their writing experience in PSP. For them, this meant that they had to reflect on how they used the scientific writing database (which included use of a word-processor) and the writing preparation tasks using the bulletin board. The following outlines the interview segment that dealt with these experiences.

Interview Extracts Of Student Approaches To Technologically-Supported Writing in PSP

The questions used in the interview to investigate student approaches to the technologically - supported part of the writing experience were:

> *What was your approach to writing with the technologies we used in the tutorial, and why did you use the technology in that way?*
>
> *What did you use the bulletin board/database/word processor for and why did you use them in that way?*

The extracts from interviews discussed here are from students who represent the categories of approaches that students brought to technologically-supported writing in PSP.

Approach 1

When asked how she used the technology in the writing process, Rebecca answered:

> "I used the word processor to write my portfolio...I used font and size and other stuff like spacing.

When asked about the other technology she might have used and why she used it, Rebecca replied:

"I used the bulletin board to access other students, like, information or staff that we did in the tutorial…I saw samples of what other students did and how they did it and get some ideas from them…like grammar."

When asked about his approach to using technology in the writing process in PSP, Danny replied:
"The database I just used as a source to copy, just to look at, and structure-wise I started to do some more to it and it just gave me ideas, how it was supposed to be structured, which way you take it."

When asked about the use of the other technology and why he used it, Danny replied:
"The database is good for answering questions, but all the factual information, you're better just to read the textbook."

Approach 2
When asked about his approach to using the technology in the writing process, Damian answered:
"Like after I've written a bit, I'll go back to the (database) exercises, like the points you need to find in the exercises, in order to put a writing portfolio task together".

When asked why he was doing that, Damian continued:
"I was trying to improve my marks."

When asked how he approached the use of the technology in the writing process, Steven responded:
"I used it (the database) a couple of times. I remember one of the exercises was repeating the words that we had so instead of starting the same sentence with the same sort of things, I looked at different ways of writing a sentence…the other ones were posted there…just helped me improve my writing."

When asked if the database and its models helped Steven learning anything else, he added:
"Oh I suppose the science as well…so I made sure I had everything right for the assignments".

Approach 3
In contrast and in response to how she went about using the technologically-supported writing processes, May said:
"Um it (the database and its exercises) just made me realize where I was at with my sort of writing and listen to a few ideas of how to go about things. And the exercises yeah, helped you get to the point, get to the fact, get the science organized and express it in a good way and get the focus happening and stuff like that."

When asked to expand on her answer, May replied:
"It helped me clarify what the science was in the first place and what it was exactly that we were going to be writing about."

When Col was asked about his approach to using the technology, he said:
"Well mainly I used the technology on the database with regards to the writing task.

When asked how and why he used it, Col replied:
"It helped me understand (the Science) a lot better because you've got a bit of a guide there and you also, because you're revising it more often."

Student Approaches To the Technologically-Supported Part of the Writing Experience in PSP
The above quotations in the three categories of approaches to technologically-supported writing in PSP differ in their referential and structural aspects. In referential terms approach A reveals the intention of using the bulletin board to check the grammar of the other students, using the database to copy and check the structure of the other students. Approach B reveals the intention of using the database to find the "points you need to find", in other words, collecting information for the

purpose of improving marks, and using the database to improve expression. When a student does mention learning the science, it is for accuracy in the assignments, rather than quality of understanding. Approach C reveals a qualitative shift from the previous categories. This category reveals an intention of using the database in ways which "clarify what the science is" and understand it a "lot better". An intention to understand the science underpins the use of the technology when it supports the writing process.

In terms of the structural aspects of the quotations, approach A emphasises collecting, copying and checking as strategies when using the technology, approach B emphasises completing the task, improving expression and using the technology to become more aware of appropriate language. Approach C emphasises developing an understanding as the strategy behind the use of the technology: both of the science and its written expression.

The patterns in the data about the student approaches to technologically-supported writing in PSP suggest the following categories:

Category	*Description*
Approach A	Using technology to collect information, copy and check structure grammar and spelling
Approach B	Using technology to complete the task, improve expression and use appropriate language
Approach C	Using technology to understand the science and express it appropriately

Table 2: Student approaches to the technologically-supported part of the writing experience in PSP

Looking at table 2 and table 1, the logical relations between the categories are apparent. They do not map exactly as their categorisation is a product of the awareness of the approach in the population of the PSP students. However, it is clear that category A of the whole approach is very close to category A of the technologically-supported approach, and a similar pattern is found between the other corresponding categories. An interesting question that is prompted by this analysis is the relationship between the approaches adopted by individual students and the relationship between their approach and performance.

The Relationship Between the Approaches Adopted by Students In the PSP Writing Experience and Performance

The categorisation of the interview data suggest relationships between the approaches students adopted to the whole writing experience, and the technologically supported part of that experience. The categorisation of the approaches apparent in the data from the interviews is shown in the table below.

Number Interviewed	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Student no.																			
Category	9	8	51	29	12	22	48	21	1	28	24	25	38	39	44	13	43	11	20
Approach to Writing	C	B	C	C	B	B	B	C	B	B	B	B	B	B	B	A	A	A	A
Approach to technologically-supported writing	C	B	C	C	B	A	A	B	B	B	B	B	A	B	B	A	B	A	A

Table 3: The variation in the student approaches to writing in PSP revealed in the interviews

The table above shows the categorisation of student approaches in the writing experience. The letters correspond to the categories of the outcome space of the approaches, and the arrows indicate the tendency towards another category indicated by the data. An arrow to the left indicates a tendency to a more complex category and an arrow to the right indicates a tendency to a less complex category.

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The relationship between these results can be determined by grouping the categories. Surface approaches, categories A and B separate an understanding of the content from the writing process and as such are a multistructural awareness of the phenomenon of writing. Category C, which is a deep approach, has the intention of understanding the content as part of the process and is a relational awareness of the phenomenon of writing. The distribution of the relationship between the whole and technologically-supported approaches to writing in PSP are shown in table 4. To assess whether or not the distribution of student responses as shown in the table were statistically significant, a phi coefficient was calculated and a fisher exact procedure was used. The fisher exact procedure of testing the statistical significance of phi coefficient is preferably used when the population is small and/or one of the numbers in the 2x2 table is less than 5.

Approaches to Writing in PSP		*Whole Approach to Writing in PSP*		*Totals*
Indicated by the Interviews		Surface Approaches *Categories A & B*	Deep Approaches *Category C*	
Technologically-supported part of the writing experience in PSP	Surface Approaches *Categories A & B*	15	1	16
	Deep Approaches *Category C*	0	3	3
Total		15	4	19

phi = 0.7, p<.01,

Table 4: Relationship between approaches to the whole writing experience in PSP and the technologically-supported approach to writing

The phi coefficient for the above table is 0.7 which indicates a strong positive relationship, statistically significant at $p<0.01$. These results indicate that students who adopted one approach to the whole experience, tended to adopt a similar approach to the technologically-supported part of the experience.

Table 5 indicates that students with a deep approach to the whole writing experience and the technologically-supported part of that experience tended to achieve at a higher level according to their writing mark. Students who adopted a surface approach had a mean writing mark of approximately 10, while students who adopted a deep approach had a mean writing mark of approximately 15. These are large effect sizes according to Cohen (Cohen, 1977).

Approaches to writing	Plant Science and Physiology, Portfolio Writing Mark	
	#Mean	SD
Whole Approach		
Surface	10.4	3
Deep	15.1	3
T test: T =	3.0*	
Technologically supported approach		
Surface	10.5	3
Deep	15.9	3
T test: T =	3.1*	

*p<0.01, # Writing Mark out of 20

Table 5: Relationship between approaches adopted and the writing mark

Directions for Research Suggested by the Results

This study is part of a larger study which involves other quantitative and qualitative methodologies to triangulate results. The 19 interviews used here are an intensive approach to mapping the approaches students adopt to writing in PSP. While valuable for their intensive nature, the interviews have mapped only 37% of the population. An extensive study using an open-ended questionnaire and closed-ended questionnaires capturing a larger percentage of the population is also being analysed, so that the relationships that appear in the interview data can be investigated to see if they are triangulated.

With the qualification of the above paragraph, the results in the above table provide valuable knowledge for reflection. The research indicates that when designing interactive learning environments for quality learning outcomes, teachers need to consider more than design and evaluation issues about the quality of the technological environment. Quality learning outcomes are related to how students use the technology. In PSP, there is variation in how students used the technology and this variation appears to be related to their approach to the whole writing experience.

Students who adopted a surface approach to the whole writing experience in PSP, one which did not foreground an understanding of the content in the writing process, tended to adopt a surface approach to the technologically-supported part of that experience. Students who adopted a deep approach to the whole writing experience, that is they sought to understand both the science and how to write the science during the writing process, approached the technologically-supported part of the experience in a similar way. These results suggest that when technology supports part of the learning processes as it does in the PSP writing experience, then quality approaches to technologically-supported learning are related to the quality of the approach the students adopt to the whole experience. If we wish to help PSP students adopt quality approaches to learning through writing when they use the technology, then helping them to improve the quality of their whole approach is likely to have positive results in the quality for their approach when using the technology.

The quality of learning outcomes when technology is involved is an important area for reflection. Developing sound research methodologies to investigate the quality of learning experiences is a worthwhile outcome of research in this period of rapid integration of learning technologies into curricula.

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